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FINAL REPORT

CERRO COPPER PRODUCTS

FOR

THE REMOVAL OF CONTAMINATED CREEK SEDIMENT AT DEAD CREEK SEGMENT A SAUGET, ILLINOIS

June 17, 1991

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FINAL REPORT

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OBJECTIVES

This report is prepared in fulfillment of the requirements of the United States District Court Consent Decree of July 5, 1990 entered by the Honorable William D. Stiehl, U.S.D.C.J., in the matter People of the State of Illinois v. Cerro Copper Products Co., Civil Action No. 90-CU-3389.

The project objectives as embodied in the Work Plan are:

- To eliminate a suspected source of contamination in and the potential recharge capacity of Dead Creek CS-A to regional groundwater.

- To protect public health by controlling potential pathways of exposure to contaminated substances.

2.0 SI/FS CONCLUSIONS

A Site Investigation/Feasibility Study (SI/FS) was performed for Cerro Copper Products Co. at Dead Creek Segment A (CS-A), located in Sauget, St. Clair County, Illinois during 1989 and 1990. This work was a site specific investigation of CS-A previously evaluated by the Illinois Environmental Protection Agency (IEPA). Also evaluated by IEPA at that time was the site east of Dead Creek CS-A, known as Site I and used by Cerro as a truck parking lot. The area west of Dead Creek CS-A was not evaluated by IEPA because it is used by Cerro for its manufacturing operations. The Site Investigation portion fully evaluated existing conditions at Dead Creek Segment A (CS-A). The information gathered during this portion of the project was utilized to evaluate alternatives for the remediation of CS-A.

The SI identified four (4) unconsolidated stratigraphic units; fill material, fluidized creek sediments, the Cahokia Unit and the Henry Formation. Fill material, which is the uppermost unit encountered outside of the creek channel, ranged in thickness from 1 to 15 feet. The fluidized creek bottom sediments ranged in thickness from one half foot to 11 feet. This unit was the uppermost unit encountered within the creek channel. The Cahokia Unit, which is situated on top of the Henry Formation, ranges in thickness from 1 to 20 feet. The Cahokia Unit consists of sediments of the upper Henry Formation which were reworked by the Mississippi River. The Henry Formation is the lowermost unit encountered at the study area. This unit is 98 to 103 feet thick and extends to the bedrock surface which is approximately 110 feet below the ground surface as reported by Ecology & Environmental under contract with IEPA. All stratigraphic units which were identified in the SI exhibited uncharacterized chemical odors. This is due, in part, to their contact with contaminants either near the ground surface or in the groundwater.

Dead Creek Segment A was characterized through a network of 34 soil borings. The results of the boring program indicated that there was approximately 19,500 cubic yards of contaminated creek bottom sediments within the 1700 linear feet of CS-A.

2.1.1 Presence of Biphenyl with PCBs

Several polychlorinated biphenyl (PCB) concentrations were detected in the sediments ranging from non-detect to 1600 mg/kg. Chemical analysis during the SI indicated that PCB concentrations were highest at the north and south ends of the north portion of Dead Creek. Throughout the history of Dead Creek, various locations of flow constrictions along the creek created zones where sediment deposition rates were high. PCBs adhering to these sediments were deposited in high concentrations at these constrictions.

2.1.2 Organic Analysis

Nine volatile organic compounds – methylene chloride, acetone, 1,2-dichloroethene, trichloroethene, toluene, chlorobenzene, ethylbenzene, xylene, and dichlorodifluoromethane – were detected in the creek channel sediments. The highest values of each of these compounds occurred at the northernmost sampling point. Concentrations varied from non-detect to 500 mg/kg (xylene).

Sixteen semi-volatile compounds – phenol, 1,3-dichlorobenzene, 1,4-dichlorobenzene, benzyl alcohol, 1,2-dichlorobenzene, 4-methylphenol, 2,4-dimethylphenol, benzoic acid, 1,2,4-trichlorobenzene, 4-chloroaniline, 3-methylphenol, acetophenone, 1,2,4,5-tetrachlorobenzene, pentachlorobenzene, butylbenzylphthalate, and bis(2-ethylhexyl)phthalate – were detected in the creek bottom sediments. The semi-volatile data indicated that the highest concentrations (99 mg/kg) also occurred at the northernmost sampling point.

2.1.3 EP Tox Metals

Six EP Tox RCRA metals were within allowable EP Tox limits. The EP Tox limit for lead (Pb) and Cadmium (Cd) were exceeded in isolated locations in the southern one-third to one-half of Dead Creek. This study was conducted prior to the initiation of TCLP. Lead reported the highest EP Tox levels at 35.40 mg/kg.

2.1.4 Summary

Based on information from the SI report, compounds contained in Dead Creek Segment A at concentrations which required remediation were PCBs, Pb and Cd. Reported values showed the PCB and their pre-cursor biphenyl concentrations are highest at the north end of CS-A and showed metal concentrations were highest in the southern one-third to one-half. Laboratory values for volatiles and semi-volatiles show concentrations for these parameters to be highest at the northernmost sampling points.

2.2 EVALUATION OF REMOVAL ALTERNATIVES

The Avendt Group, Inc. initially screened 29 remedial technologies (listed at Figure 2.1) which are described in Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, June 1988. After the technology screening was completed, a number of these processes were included in four action alternatives, which were examined in detail. A "No Action" alternative was also included.

To assure consistency with the National Contingency Plan (NCP), for a removal action, the four action alternatives were chosen by considering the following selected criteria:

- Actual or potential exposure to nearby human population, animals of the food chain from hazardous substances or pollutants or contaminants.
- Actual or potential contamination of drinking water supplies.
- Hazardous substances or pollutants or contaminants in drums, barrels, tanks or other bulk storage containers.
- High levels of hazardous substances or pollutants in soils largely at or near the surface that may migrate.
- Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released.
- Threat of fire or explosion.
- Other factors which may pose a threat to public health or welfare of the environment.

2.2.1 Alternative 1: No Action

This alternative provided a base line against which the other actions were measured. Under this alternative, the CS-A would be left in its existing state, which includes site security provisions. As a result, there would be no reduction in potential contaminant migration from the site, and the potential contact hazards associated with the contamination would not be minimized or eliminated. Therefore, the No Action Alternative would afford a low level of protection of human health and the environment.

2.2.2 Alternative 2: Off-Site Landfill

Based on the information contained in the SI, this alternative would involve the excavation of approximately 19,500 cubic yards of contaminated sediment. As estimated in the SI/FS, the excavated sediment will be dewatered within Dead Creek CS-A by gravity separation to 75

INITIAL REMEDIAL TECHNOLOGIES EVALUATION/SCREENING FOR CS-A CONTAMINATED SEDIMENTS

REMEDIAL TECHNOLOGIES	IMPLEMENTABILITY*	EFFECTIVENESS**	COST***
Multi-Layer Capping			
On-Site Incineration			
Off-Site Incineration			
Excavation and Removal			
On-Site Disposal	XXXXX		
Off-Site Disposal			
Lagoon Covers		XXXXX	
Grading			
Re-vegetation			
Dikes and Berms		XXXXX	
Channels and Waterways	XXXXX	XXXXX	
Seepage Basins and Ditches	XXXXX	XXXXX	
Sedimentation Basins and Ponds		XXXXX	
Levees and Floodwalls		XXXXX	
Active Interior Gas Collection	XXXXX	XXXXX	
Recovery System			
Water Spraying	XXXXX	XXXXX	
Groundwater Pumping		XXXXX	
Slurry Walls			
Grouting	XXXXX	XXXXX	XXXXX
Sheet Piling	XXXXX	XXXXX	
Bottom Sealing	XXXXX	XXXXX	XXXXX
Bioreclamation	XXXXX	XXXXX	
Soil Flushing	XXXXX	XXXXX	
Immobilization	XXXXX	XXXXX	
Detoxification	XXXXX	XXXXX	
In Situ Vitrification	XXXXX	XXXXX	XXXXX
Surface Microencapsulation	XXXXX	XXXXX	
Thermoplastic Solidification		XXXXX	
Liquid Injection	XXXXX	XXXXX	XXXXX
Fluidized Bed	XXXXX	XXXXX	

XXXXX - Basis for Elimination

* *This criterion is based on the technical feasibility and availability of the technologies each alternative would employ and the administrative feasibility of implementing the alternative.*

** *This criterion focuses on the degree to which an alternative reduces toxicity, mobility, or volume through treatment, minimizes residual risks and affords long-term protection, complies with ARARs, minimizes short-term impacts, and how quickly it achieves protection.*

*** *The costs of construction and any long-term costs to operate and maintain the alternatives shall be constructed.*

percent solids, which will result in 10,400 cubic yards of solids to be disposed off site in a permitted landfill. (As-built quantities are discussed in Section 4.0.) During the removal of the contaminated sediments, entrained water will drain within the excavation area. Following the removal of the contaminated sediments, CS-A will be backfilled with clean fill. The site will be graded and covered with crushed stone to provide erosion control and a wearing surface for vehicles. The initial plans for re-vegetation of clean fill material were changed.

The Off-Site Landfill Alternative will afford a high level of human health and environmental protection in the vicinity of the site. The excavation of sediments and disposal at an off-site landfill will eliminate sediment contamination as a source and the need for long-term monitoring. There will be a minor and acceptable risk to human health and the environment along the travel routes to the landfill and at the landfill itself.

This alternative requires attention to the issues of work safety and short-term impacts. The presence of hazardous or toxic materials can pose a risk to worker safety. Short-term impacts such as fugitive dust emissions, air release, and contaminated run-off require mitigation.

The Off-Site Landfill Alternative was determined to comply with Chemical and Action Specific ARARs.

2.2.3 Alternative 3: Off-Site Incineration

Instead of being directly disposed in a permitted landfill, the 10,400 cubic yards of solids will first be shipped to a permitted commercial incineration facility to destroy an estimated 12% organic fraction. The incinerator residue, estimated at 6,900 cubic yards, will require chemical stabilization to retard potential leaching which will increase the volume of solids to be landfilled by an estimated fifty percent for a total of 10,350 cubic yards.

The Off-Site Incineration Alternative would afford a high level of protection of human health and the environment at CS-A. The excavation of sediments, transportation for treatment at an off-site incinerator and subsequent landfill of residue will eliminate the sediments as a source of contamination and the need for long-term monitoring. CS-A would be backfilled and the ground contoured to facilitate drainage.

The Off-Site Incineration alternative was determined to comply with all the Chemical, Action and Location Specific ARARs.

2.2.4 Alternative 4: On-Site Incineration

Instead of direct disposal in a permitted landfill, 10,400 cubic yards of solids will first be treated on site with a mobile incinerator. The on-site incinerator scrubber water or sludge will require treatment and will further increase the amount of solids requiring subsequent disposal. The residual material (ash and air pollution control residuals) would be treated to retard potential leaching of metals and disposed in an approved U.S. EPA landfill. CS-A would be filled to its original bank level elevation and graded with clean fill. A final drainage and erosion control plan would be implemented.

The On-Site Incineration Alternative will afford a medium level of environmental protection in the vicinity of the site. Off-site hauling would be required for transport and disposal of the incinerator residue.

The On-Site Incineration Alternative was determined to comply with all the Chemical, Action and Location Specific ARARs.

2.2.5 Alternative 5: Multi-Layer Cap

This alternative will involve the construction of a Resource Conservation and Recovery Act (RCRA) equivalent cap at grade over the contaminated sediments to provide containment and to minimize the migration of the contaminants. The construction of underground slurry walls will isolate the sediments from the groundwater and the regional groundwater contamination. Long-term operation, maintenance and monitoring of the facility will be required to ensure the integrity of the engineered containment for this alternative and restrictions would have to be placed on the property deed to prevent damage to the structure.

The Multi-Layer Capping Alternative will afford a low level of protection for human health and the environment. The degree of environmental and human health protection is contingent upon long-term maintenance of the integrity of the capping system. Land use restriction may be permanently imposed to protect the public health.

The Multi-Layer Cap Alternative was determined to comply only with the Clean Air Act and OSHA ARARs.

2.2.6 Summary

Each of the alternatives was evaluated according to U.S. EPA guidance and Section 121 of SARA and the criteria contained in "Additional Interim Guidance on Superfund Selection of Remedy," dated July 24, 1989. A comparison summary is at Figure 2.2.

2.2.6.1 Long-Term Effectiveness and Permanence

Off-Site Landfill provides effectiveness through engineering controls and offers the highest degree of effectiveness and permanence by containing the contaminated sediments in an existing permitted off-site landfill.

Both incineration alternatives provide for only long-term effectiveness and permanence through destruction of organics and PCBs. Extensive pollution control equipment would be necessary to capture the volatilized metals in the flue gas. Both the ash and the air pollution control equipment residuals could also be more toxic and would require chemical stabilization of heavy metals prior to landfill disposal. Therefore, incineration alternatives were given a medium ranking with regard to long-term effectiveness and permanence.

No Action and the Multi-Layer Cap offered the least long-term effectiveness of all the alternatives evaluated. Long-term monitoring and maintenance would be required to assure the permanence of this remedy.

2.2.6.2 Reduction of Toxicity, Mobility and Volume

Off-Site Landfill offers a high degree of reduction of mobility by moving the contaminated sediments from their present position and placing them in a secure permitted landfill. No change in the toxicity or volume is anticipated.

Off-Site Incineration and On-Site Incineration offer a negligible degree of reduction of volume. The residue from the incinerator would be 98 percent dry solids. However, the incineration of the heavy metal contaminated sediments will require chemical stabilization of the ash and air pollution abatement residue to reduce mobility and toxicity. This chemical stabilization will increase the volume of the material requiring landfill disposal.

No Action and the Multi-Layer Cap offer the lowest degree in reducing toxicity, mobility and volume.

Figure 2.2 Comparative Analysis of Remedial Action Alternatives According to Evaluation Criteria

EVALUATION CRITERIA*	ALT 1 NO ACTION	ALT 2 OFF-SITE LANDFILL	ALT 3 OFF-SITE INCINERATION	ALT 4 ON-SITE INCINERATION	ALT 5 MULTI-LAYER CAP
Protection of Human Health and the Environment	Low	High	High	Medium	Low
Compliance with ARARs	Low	High	Medium	Medium	No
Long-Term Effectiveness and Permanence	Low	High	Medium	Medium	Low
Reduction of Toxicity Mobility and Volume	Low	High	High	High	Low
Short-Term Effectiveness	Low	High	High	Low	High
Implementability	High	High	Medium	Low	Medium
Cost** Capital O & M	—	12.0/	17.0/0	20.0/0	5.1/ 1.6 Million
Regulatory Acceptability	Low	High	High	High	Medium
Community Acceptance	Low	High	High	Low	Low

*Reference: *USEPA Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, June 1988.*

**Cost Figures Indicate: *Total Capital Cost (In Millions of Dollars)/Operation and Maintenance Costs are in Millions of Dollars and represent present worth of a 30-year groundwater monitoring program.*

2.2.6.3 Implementability

No Action and Off-Site Landfill would be easily implemented using standard materials, equipment and methods.

On-Site incineration cannot be fully implemented without permitting and until a trial burn is conducted. Necessary permits include air and water permits and RCRA and TSCA permits. The permit process could take more than three years. Local opposition to on-site incineration of hazardous materials may also serve to delay and/or preclude obtaining permits. In addition, it is unlikely that conventional mobile incinerations would be equipped with air pollution control equipment needed to treat the volatile metals released during incineration.

The Multi-Layer Cap may also be easier to implement but the permitting process would also take several years and may receive local opposition: the Cap was ranked medium for implementability.

Off-Site Incineration also provides a medium degree of implementability. The off-site incineration facilities which may be used have contractual commitments to clients which may result in excessive delays of incineration, especially with increased incineration demand rising from the RCRA land disposal restrictions.

2.2.6.4 Community Acceptance

Off-Site Landfill and Off-Site Incineration carry a high degree of community acceptance since the contaminants will be physically removed from the immediate area and either treated or disposed. The remaining alternatives carry a low degree of community acceptance since the creek sediments would not be removed from the immediate area.

2.2.6.5 Protection of Human Health and Environment

The protection of human health and the environment involves the identification of potential exposure routes and an evaluation of the mitigation of contamination along those routes. The possible routes of exposure associated with the remediation of CS-A are: 1) air, 2) surface water, 3) groundwater, and 4) creek sediment.

Under the No Action Alternative, the site would be left in its existing state which includes site security provisions. As a result, there would be no reduction in potential contaminant migration from the site, and the potential contact hazards associated with the contamination would not be minimized or eliminated once inside the fence which surrounds the site. Therefore, the No Action alternative will afford a low level of protection of human health and the environment.

The Off-Site Landfill Alternative will afford a high level of human health and environmental protection in the vicinity of the site. The excavation of sediments and disposal at an off-site landfill will eliminate sediment contamination as a source and the need for long-term monitoring, with but a minor and acceptable risk to human health and the environment along the travel routes to the landfill and at the landfill itself.

The Off-Site Incineration Alternative would afford a high level of protection of human health and the environment at CS-A. The excavation of sediments, transportation for treatment at an off-site incinerator and subsequent landfill or residue will eliminate the sediments as a source and the need for long-term monitoring. There will be a minor, but acceptable, risk to human health and the environment along the travel routes to the incinerator and then to the landfill, and with the landfill itself.

The On-Site Incineration Alternative will afford a medium level of environmental protection in the vicinity of the site as a result of utilizing a single rotary kiln mobile incinerator in this remediation alternative. Off-site hauling would be required for transport of the incinerator residue.

The Multi-Layer Capping Alternative will afford a low level of protection for human health and the environment. The degree of environmental and human health protection is contingent upon long-term maintenance of the integrity of the capping system. Land use restriction may be permanently imposed to protect the public health.

2.2.6.6 Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

The analysis for compliance of ARARs involves the identification of ARARs and assessment of how each alternative will meet them. The types of ARARs are: 1) Chemical Specific, 2) Action Specific, 3) Location Specific, and 4) To Be Considered.

The No Action Alternative was determined not to comply with all Chemical, Action Specific ARARs as outlined in Figure 2-3. It was determined that no "To Be Considered" ARARs are relevant and appropriate to this alternative.

The Off-Site Landfill Alternative was determined to comply with Chemical and Action Specific ARARs as outlined in Figure 2-3. There were no Location Specific or "To Be Considered" ARARs which apply to this remedial alternative.

ARARs	ALT. 1 NO ACTION	ALT. 2 OFF-SITE LANDFILL	ALT. 3 OFF-SITE INCINERATION	ALT. 4 ON-SITE INCINERATION	ALT.5 MULTI-LAYER CAP
CHEMICAL SPECIFIC ARARs					
TSCA PCB REGULATIONS	NO	YES	YES	YES	NO
RCRA HAZARDOUS CHARACTERISTICS	NO	YES	YES	YES	NO
CWA PRETREATMENT REQUIREMENTS	NO	YES	YES	YES	NO
CAA AIR EMISSIONS	N/A	YES	YES	YES	YES
ACTION SPECIFIC ARARs					
RCRA* MINIMUM TECHNOLOGY	NO	YES	YES	YES	NO
CAA TREATMENT REQUIREMENTS	N/A	YES	YES	YES	YES
CWA PRETREATMENT REQUIREMENTS	NO	YES	YES	YES	NO
TSCA PCB MGMT. REQUIREMENTS	NO	YES	YES	YES	NO
OSHA	N/A	YES	YES	YES	YES
LOCATION SPECIFIC ARARs					
CAA PRETREATMENT REQUIREMENTS	N/A	N/A	YES	YES	YES
CWA PRETREATMENT REQUIREMENTS	N/A	N/A	YES	YES	NO
TSCA PCB MANAGEMENT REQUIREMENTS	N/A	YES	YES	YES	NO

TO BE CONSIDERED REQUIREMENTS
—NO ARARs ARE CONSIDERED TO APPLY—

*NOTE: Includes consideration of land disposal restrictions and CERCLA exemption provisions for these alternative remedial actions.

The Off-Site Incineration Alternative was determined to comply with all the Chemical, Action and Location Specific ARARs. No To Be Considered requirements were identified in Figure 2-3.

The On-Site Incineration Alternative was determined to comply with all the Chemical, Action and Location Specific ARARs. No To Be Considered requirements were identified in Figure 2-3.

The Multi-Layer Cap Alternative was determined to comply only with the CAA and OSHA ARARs.

2.2.6.7 Short-Term Effectiveness

The most advantageous alternatives are Off-Site Landfill and Off-Site Incineration because of their overall positive environmental impacts and speed with which they can be implemented, although Off-Site Incineration may be slowed by limited availability of off-site incinerators. Because of the rapid implementation of the remedial activity, exposure to the remedial workers and the community during remediation will be limited.

On-Site incineration would be slow to implement due to permitting requirements and construction time. Also, this alternative increases the exposure to the community which would not be an issue with the two off-site alternatives.

Off-Site Landfill, Off-Site Incineration, and Multi-Layer Cap all provide short-term effectiveness. Installation time is one year and would quickly minimize exposure pathways for the community such as air and sediment contact. The Off-Site Landfill alternative has the added advantage of reducing the risk of exposure to workers because of reduced material handling. The material is handled once prior to disposal. With the incineration alternative, the material is handled several times: loading in the truck, loading the incinerator, stockpiling ash for classification, and loading ash for disposal. The Multi-Layer Cap and "No Action" offer little exposure to remedial workers. Short-term effectiveness would depend on the Operation and Maintenance Program. "No Action" has no short-term effectiveness.

2.2.6.8 Cost

The cost estimates developed are for use in developing remedial action budgets, feasibility study cost estimates or more detailed cost. Final costs of the project will depend on the final project scope, actual labor and materials costs, actual site conditions, productivity, competitive market conditions, final project schedule, and other variable projects.

2.2.6.9 Regulatory Acceptance

Off-site Landfill, Off-Site Incineration, and On-Site Incineration are projected to carry a high degree of regulatory acceptance since the creek sediments will be physically removed from their present position and either treated or isolated form human and environmental exposure. Multi-layer Cap is projected to carry a medium level of regulatory acceptance since the creek sediments would only be capped and isolated from direct human contact. No Action is projected to have a low level of regulatory acceptance.

2.3 RECOMMENDED COURSE OF ACTION

The recommended remediation alternative was a removal action that involved the excavation of approximately 20,000 cubic yards of contaminated creek sediment located at varying depths within Dead Creek CS-A, sediment disposal in an off-site landfill and site restoration by backfill, grading and erosion control. Upon excavation of each creek zone, the stockpiled material will be loaded for transport to an off-site RCRA-permitted landfill. Depending upon PCB content, the landfill may also be TSCA approved.

3.0 PHASE I: STORMWATER RUNOFF DIVERSION

3.1 PURPOSE

Prior to the sediment removal activity, the stormwater runoff from Cerro's manufacturing facility needed to be diverted from Dead Creek. Dead Creek was used as a stormwater retention and emergency holding basin for the Village of Sauget's sewer system. During storm events, the majority of Cerro's facility runoff was directed to Dead Creek and in the event of a heavy storm, the Village of Sauget's sewer system would backup into Dead Creek. To capture stormwater from the Cerro facility, a 1.0 million gallon stormwater retention and pumping system was constructed. The discharge from this system was hard piped into the Village sewers; consequently, the Village sewers were prevented from backing up into the Creek. The diversion prevented storm events from interfering with removal activity, but more important, allowed Cerro to fill in CS-A after the removal action.

3.2 DESCRIPTION

The stormwater collection, retention and pumping system was designed to handle a 10 year-12 hour storm. The storage system includes a 1,600 foot box culvert providing 600,000 gallons of storage and a retention basin providing 400,000 gallons of storage. Stormwater pumping capacity was designed for a 9.000 gpm. The discharge from the retention basin is piped to a 21" pipe that was sleeved into the 30" Village sewer that connected Dead Creek to the Village sewer system. The annular space between the two pipes was grouted.

Construction of the stormwater system began in late November, 1989 with the installation of dewatering wells. Dewatering wells were needed to create a cone of depression in order for the construction to begin. Samples taken by Cerro of the water pumped from the well showed metal values less than 0.2 ppm with the exception of iron, measured at 11 ppm. Cerro also measured total Organic Carbon (TOC) at values less than 20 ppm, indicating no groundwater contamination as a result of dewatering. In addition, the Village of Sauget took periodic water samples because the water was pumped to their wastewater treatment facility. The viilage of Sauget did not notify Cerro of any problems encountered.

The system has been in operation since June 1990.

The actions completed to achieve the project objectives are described in this section. Figure 4-1 is an Organization Chart showing the interrelationships among project participants. The project was completed in accordance with the Consent Decree.

4.1 PRE-EXCAVATION SAMPLING AND ANALYSIS

During the Site Investigation/Feasibility Study, the creek sediment was sampled to characterize the soil. Initial determination of contaminants was made from a total of 99 samples in a network of 34 sediment soil borings distributed on 10 East-West transverses across Dead Creek CS-A. Just prior to excavation, a second testing program was initiated to further define the location of hot spots and general contaminated areas. Samples were taken on the center line of Dead Creek every 50 feet and analyzed for PCBs and extractable lead and cadmium. This information was used to estimate the final quantities of material for each anticipated waste classification for contractors bid packages.

4.2 INTERCEPTOR TRENCH

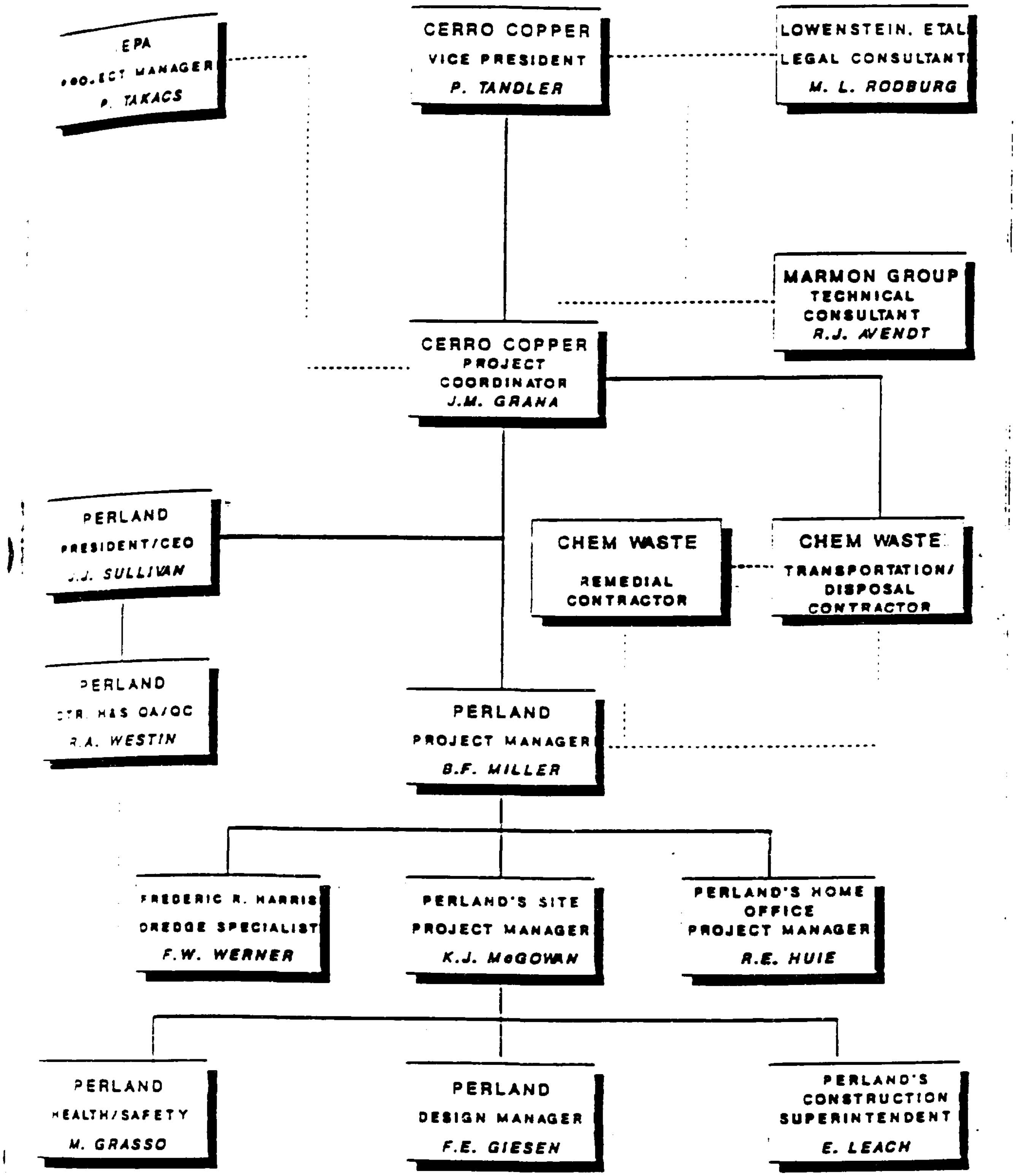
During the construction phase, it was often necessary to remove surface water that collected in Dead Creek through pumping, in order to proceed with scheduled remediation objectives. An interceptor trench, approximately 5' wide and 2-3' deep, was dug north-south parallel to Dead Creek CS-A just to the east side of the existing railspur along the entire length of the creek. The interceptor trench was designed so that any water collected in the trench would flow north to south toward New Queeny Road at the south end of the site and into the Village of Sauget sewer system. The interceptor trench was responsible for significantly reducing the amount of surface water that reached the Creek from the east bank. Overall project pumping costs were significantly reduced.

4.3 EXCAVATION AND BACKFILL

Approximately 20,000 cubic yards of wet sediments resulting in 27510 tons of dry sediments were removed from the Dead Creek CS-A site. This includes contaminated portions of fill material within the creek, as well as the underlying fluidized creek sediments. Excavation proceeded from South to North as cranes with clam shell attachments and long-boom backhoes were used to remove the sediment. Clean backfill was placed in the excavated areas to elevations of 402' (South creek) and 400' (North creek). Sediment was then piled on the clean fill within the wetted bank line of Dead Creek, which was defined as the elevation contour 401'.

Figure 4-1 Cerro Copper CS-A Site Organization Chart

DEAD CREEK CS-A REMEDIAL ACTION ORGANIZATION CHART



4.3.1 Extent of Excavation

Extensive probing operations were performed prior to excavation to determine the depth of contaminated sediment across the creek bed. Cross sections showing the extent of contaminated sediment, based on the probing results, were plotted every 50 feet perpendicular to the length of the creek. The average-end-area method was used to determine the volume of loose sediment in the creek. Cross sections were also used to define the depth to the interface separating contaminated sediments and the clean underlying Cahokia layer. Drawings of cross sections are shown in Section 7.2.

4.3.2 Depth of Excavation

Two criteria were used to determine completion of excavation: 1) physical measurements of excavated elevations, and 2) visual inspection of the underlying clean Cahokia layer as compared to the overlying contaminated creek sediments (see Section 6.2.2).

4.3.3 Volume of Excavation

To assure complete contaminated sediment removal. the Creek bottom was over-excavated approximately 6-36 inches into the Cahokia bedding layer. The over-excavated material plus the sediment resulted in a final volume excavated of approximately 24,000 cubic yards.

4.4 DEWATERING

The Consent Decree did not allow treatment of creek material outside the confines of CS-A because of permit requirements. As a result, all dewatering activities were kept within creek boundaries.

4.4.1 Dewatering Method Investigation

An on-site test program evaluated the best method of dewatering the contaminated sediment without using mechanical methods, which would have been used outside CS-A, such as a centrifuge or a filter press. The saturated sediment was first placed on a sand bed. Water rapidly drained out of the sediment in contact with the sand and formed an impervious, fine sediment or silt barrier trapping the entrained water and prohibiting further drainage. Evaporation at the surface of the sediment pile created a similar impervious barrier. Breaking the surface crust revealed a great amount of interstitial water. To facilitate drainage and evaporation, material piled for gravity dewatering was mixed using a backhoe, continuously exposing wet material to the air. Other dewatering methods investigated included a flame heater which blew hot air onto the drying beds, as well as a variety of large fans meant to speed up the evaporation process.

4.4.2 Dewatering Method Chosen

After excavation of the contaminated sediments, a granular backfill material was backfilled into Dead Creek to elevations of approximately 402' (south creek) and 400' (north creek). It served as a platform upon which the contaminated sediments were placed and then allowed to drain. During the drainage period, backhoes stirred the wet material to facilitate evaporation and drainage through the granular backfill. Care was taken during this period to monitor VOC emissions to assure personal protection action levels were not exceeded. Vapor suppressing foam was present to control emissions. Dewatering was complete when a composite sample of the material passed the paint filter test (approximately 70-75% solids) indicating no free liquids. The process continued until all sediment was placed upon the granular backfill, dewatered, and tested for waste classification.

4.4.3 Calcium Oxide Addition

Because the project was under severe time restraints and dewatering operations took much longer than anticipated, permission was granted to add a dehydrating agent to the sediments to significantly speed dewatering. Calcium oxide, or quick lime, was chosen and dewatering was completed on schedule. Typical sediment drying times were:

Without CaO	50-60 days
With CaO	5 days

Total amount of CaO added was 250 tons.

Only a portion of the creek necessitated drying using quicklime. A number of factors contributed to the slow drying time of these sediments: (1) the sediments began drying at a later time in the year and thus did not experience the summer heat/drying conditions that other portions did. (2) The percent water of these sediments was a great deal higher than in other portions of the creek due to a reduction in the size of the creek creating a ponding effect, as well as rainy weather conditions in the later autumn months. (3) Time restraints due to project scheduling.

4.5 MATERIAL CLASSIFICATION

Destaged material was classified into six categories:

- Non-hazardous Material
- RCRA Waste (No Treatment Required)
- RCRA Waste (Treatment Required)
- TSCA Waste
- RCRA/TSCA Waste (No Treatment Required)
- RCRA/TSCA Waste (Treatment Required)

The classification decision tree is shown at Figure 4-2.

4.5.1 Description of Sampling and Analysis

During the SI analysis for site waste characterization, the only classified wastes exceeding hazardous waste classification limits were Cd, Pd and PCBs, and these compounds became the target contaminants. During Remedial Action, the dewatered sediment was divided in separate piles for testing. Figures 4-3A through 4-3H indicate the division and the results for each classification. Following is a description of the test methods.

4.5.1.1 RCRA Waste

TCLP tests were performed on composite samples of dewatered sediment from volumes of 1,000 cubic yards or less. Test results showing that the concentrations of either of the target contaminant inorganic ions, cadmium or lead, were present in amounts greater than 5 ppm for lead or greater than 1 ppm for cadmium were classified a RCRA waste. After the Third-Third List of land disposal restrictions was implemented, material containing TCLP organics exceeding their Target Concentration Limits was also classified as RCRA waste: benzene (>0.5 ppm), 1,4-dichlorobenzene (>7.5 ppm), hexachlorobenzene (>0.13 ppm), tetrachloroethylene (>0.7 ppm), and trichloroethylene (>0.5 ppm). An EP Tox test for Pb and Cd was performed to determine if the waste was to be treated before depositing in the landfill.

4.5.1.2 TSCA Waste

A sample was taken from the dewatered sediments in volumes approximating 100 cubic yards for an analysis of total PCB content. Material exceeding 50 parts per million total PCBs was isolated and designated as a TSCA waste. TSCA material was loaded into transportation equipment, properly marked, and transported to a permitted TSCA landfill.

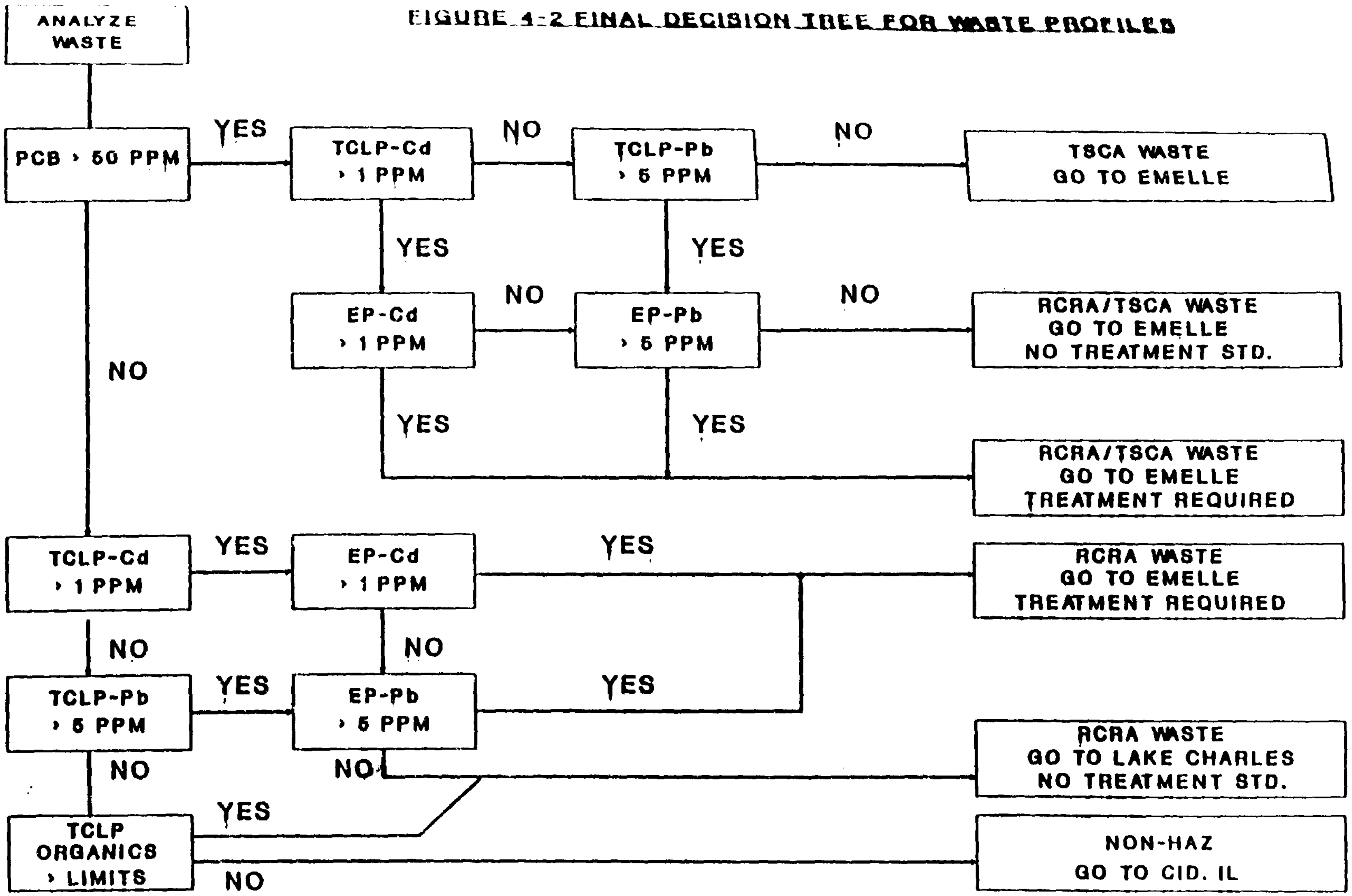
4.5.1.3 RCRA/TSCA Waste

Samples failing to pass the TCLP (Pb, Cd and/or organics) and the total PCB test were classified as RCRA/TSCA mixed waste. Further EP Tox tests were completed to determine if the material required treatment before depositing in the landfill. This waste was properly isolated, loaded on transportation equipment, labeled and disposed in a landfill permitted with a RCRA Part B and TSCA permits.

4.5.1.4 Non-Hazardous Material

Material passing the TCLP and PCB tests were classified as non-hazardous material and loaded res transportation equipment, properly marked and manifested. To assure maximum containment, disposal was in an RCRA Part B permitted landfill.

FIGURE 4-2 FINAL DECISION TREE FOR WASTE PROFILES



LIST OF TCLP ORGANICS OF CONCERN & LIMITS

D018 BENZENE - 0.5 PPM
D027 1,4,-DICHLOROBENZENE - 7.5 PPM
D032 HEXACHLOROBENZEN - 0.13 PPM
D039 TETRACHLOROETHLYENE - 0.7 PPM
D040 TRICHLOROETHYLENE - 0.5 PPM

Figure 4-3A

CERRO - DEAD CREEK CS-A
SAMPLING PLAN LEGEND

WASTE CLASSIFICATION (COLOR CODE)

RCRA/TSCA (NO TREATMENT REQUIRED)

RCRA/TSCA (TREATMENT REQUIRED)

RCRA (NO TREATMENT REQUIRED)

RCRA (TREATMENT REQUIRED)

TSCA (NO TREATMENT REQUIRED)

NON-RCRA/NON-HAZARDOUS

LIMITS OF STOCKPILES DESIGNATED

CERRO - DEAD CREEK OSA

SAMPLING PLAN

(STA 17 + 00 TO 15 + 00)

SCALE: Vertical 1" = 20'
Horizontal 1" = 30'

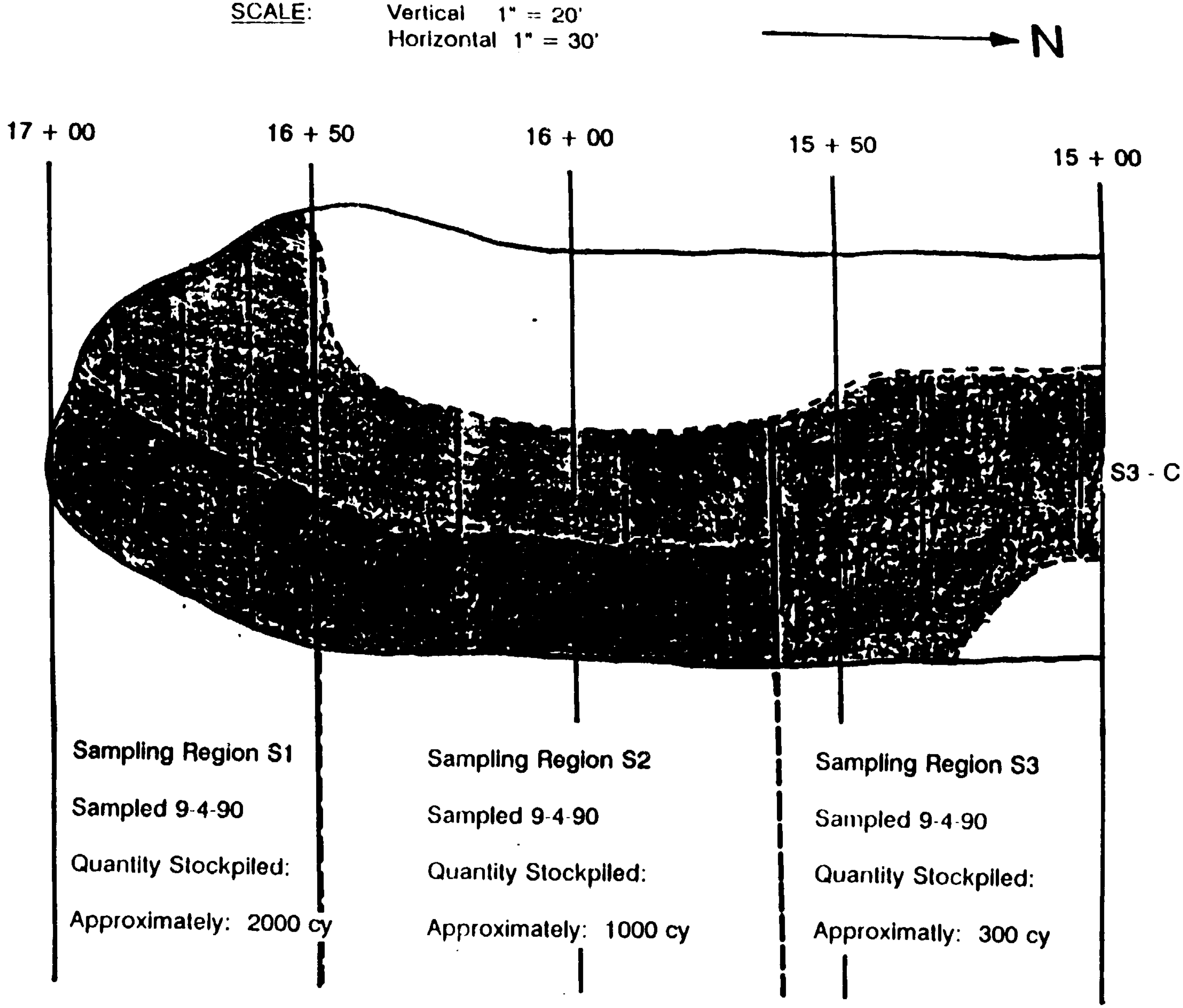


Figure 4-3B

19

CERRO - DEAD CREEK CS A
SAMPLING PLAN
(STA 15 + 00 TO 13 + 00)

SCALE: Vertical 1" = 20'
Horizontal 1" = 30'

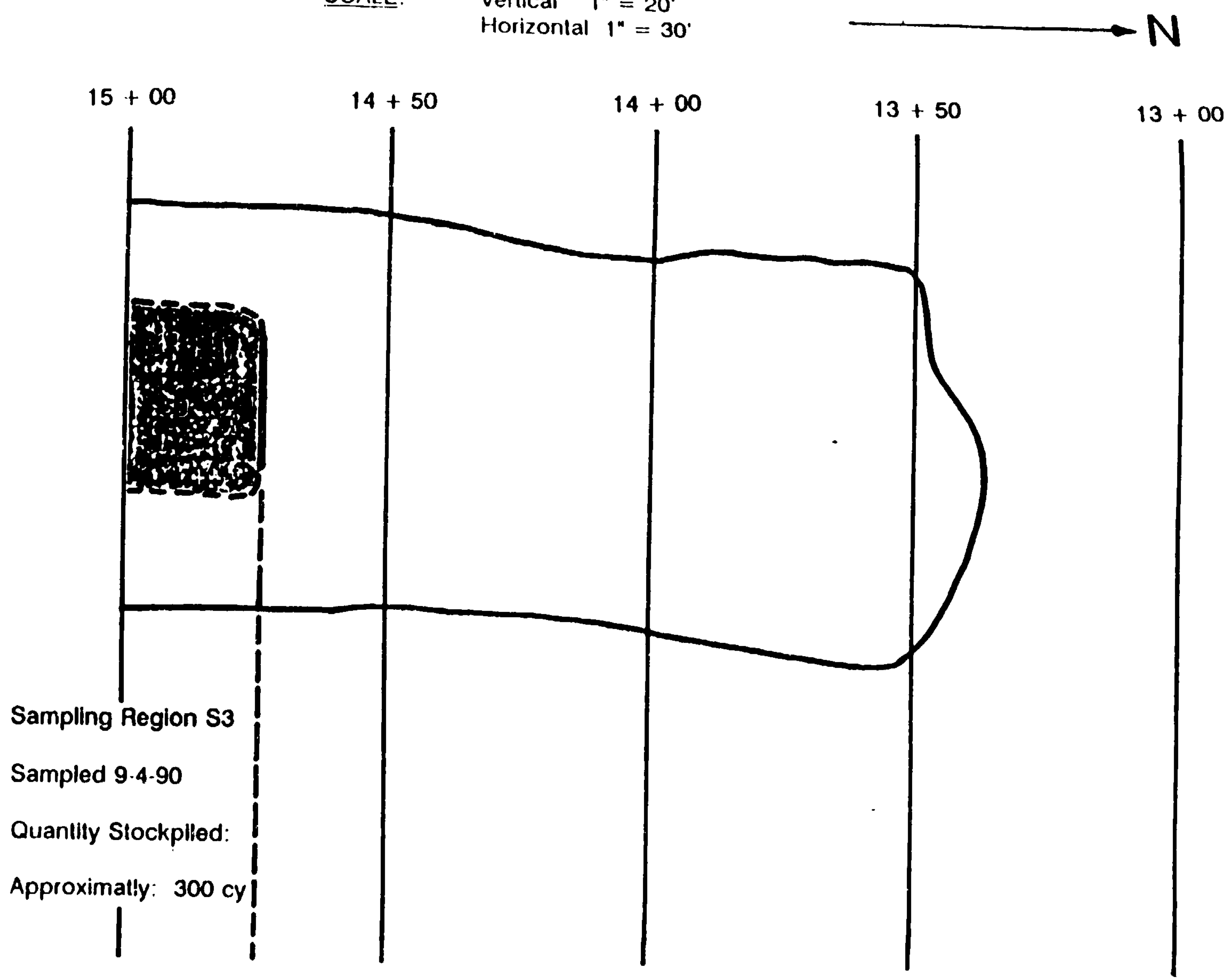


Figure 4-3D

CERRO DEAD CREEK CS A
SAMPLING PLAN
(STA 13 + 00 TO 10 + 50)

SCALE: Vertical 1" = 20'
Horizontal 1" = 30'

N

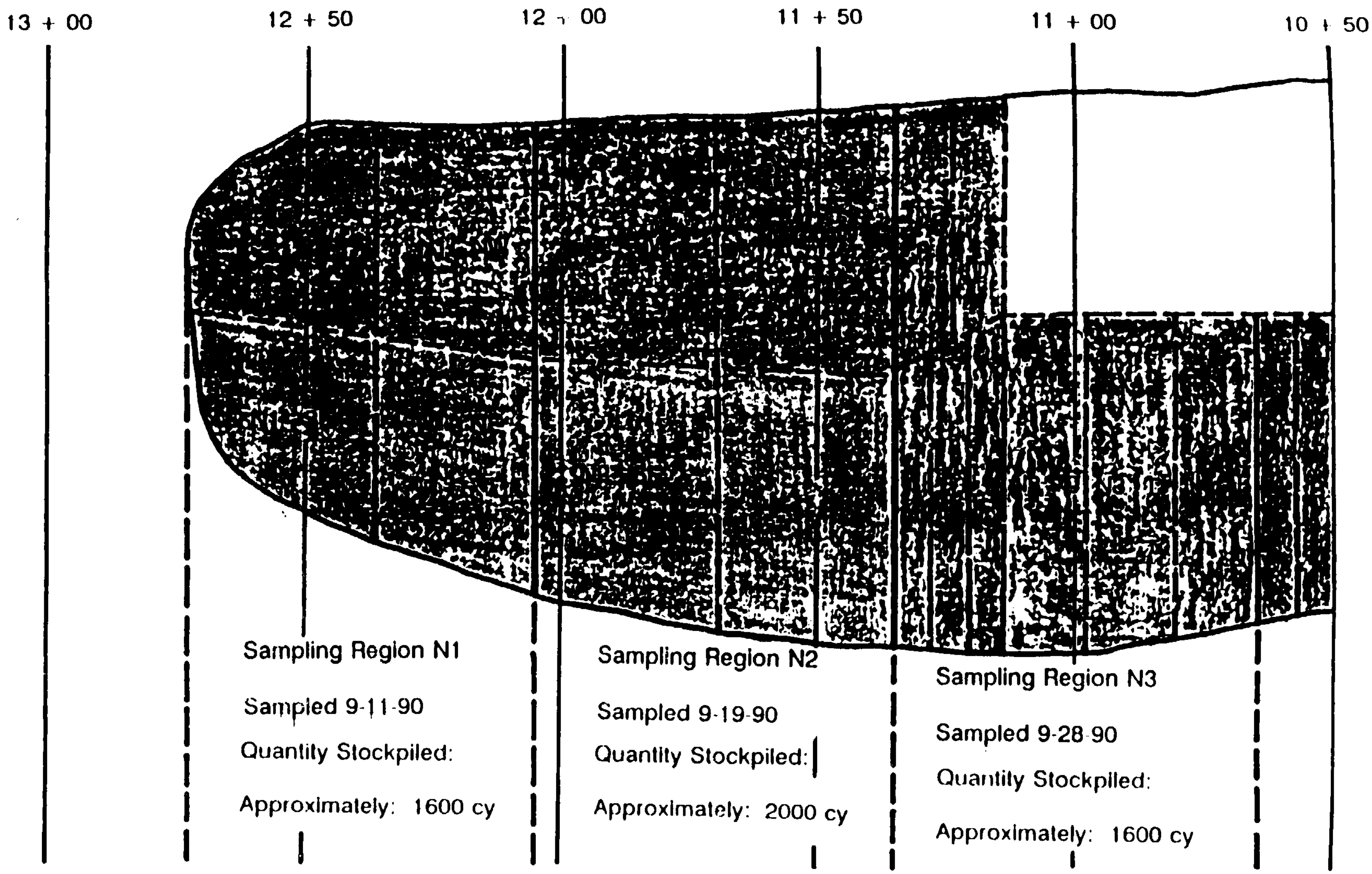


Figure 4-3E

CERRO - DEAD CREEK CS A
SAMPLING PLAN
(STA 10 + 50 TO 8 + 00)

SCALE: Vertical 1" = 20'
Horizontal 1" = 30'

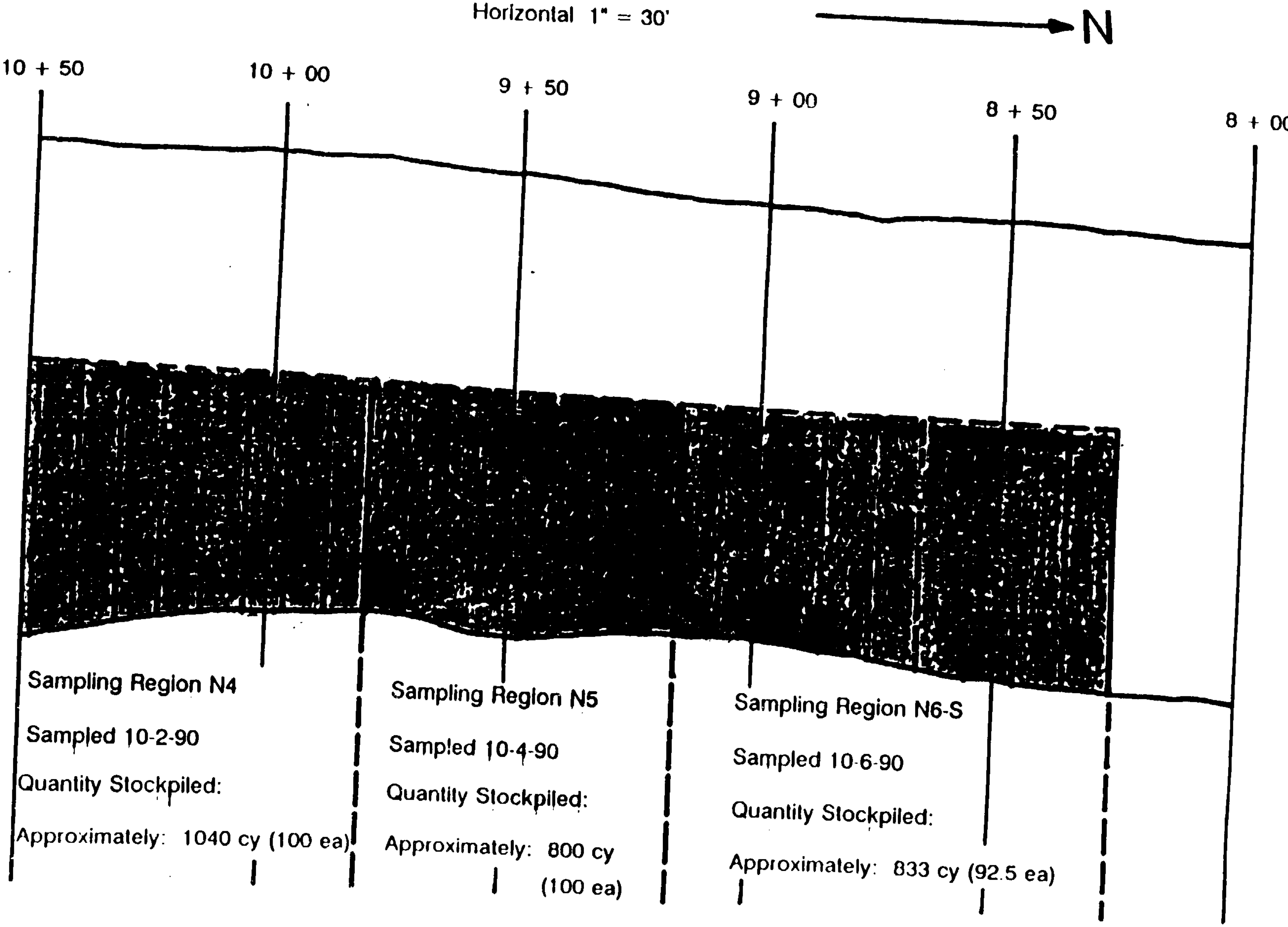


Figure 4-3F

CERRO DEAD CREEK CS A
SAMPLING PLAN
(STA 8 + 00 TO 5 + 50)

SCALE: Vertical 1" = 20'
Horizontal 1" = 30'

N

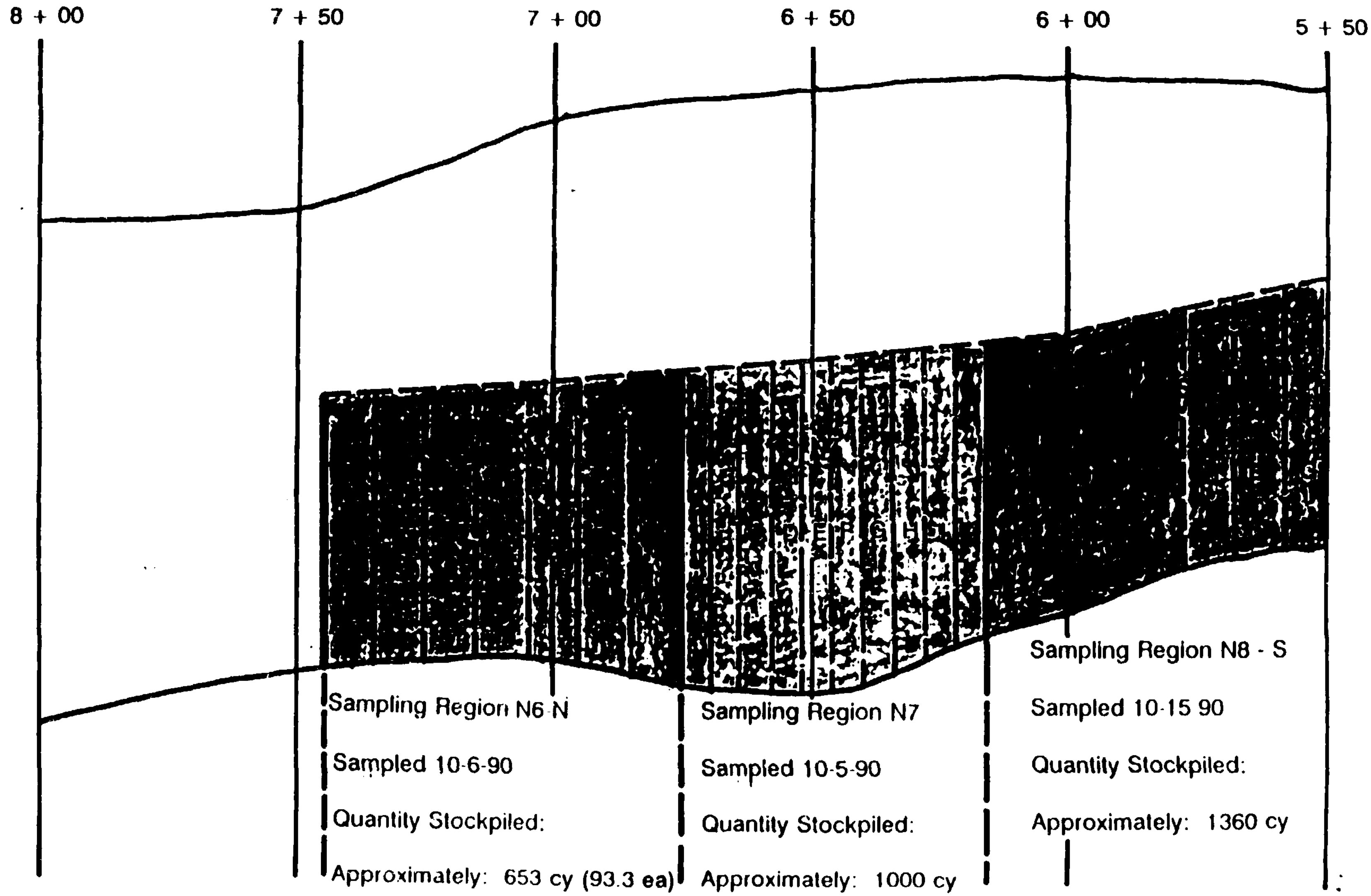
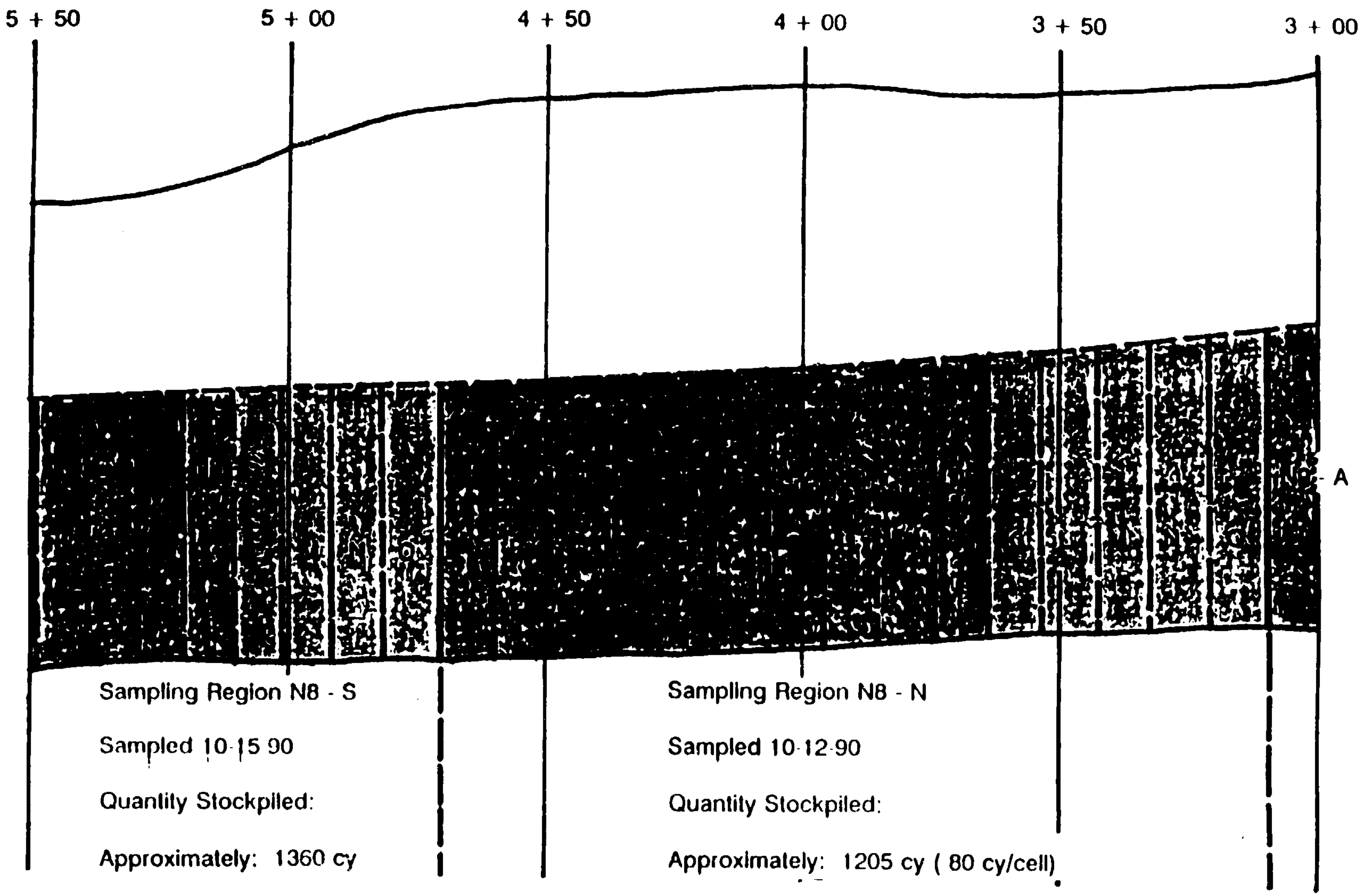


Figure 6-3C

CERRO - DEAD CREEK CS A
SAMPLING PLAN
(STA 5 + 50 TO 3 + 00)

SCALE: Vertical 1" = 20'
Horizontal 1" = 30'

N



CERRO DEAD CREEK CS A
SAMPLING PLAN
(STA 3 + 00 TO 0 + 50)

SCALE: Vertical 1" = 20'
Horizontal 1" = 30'

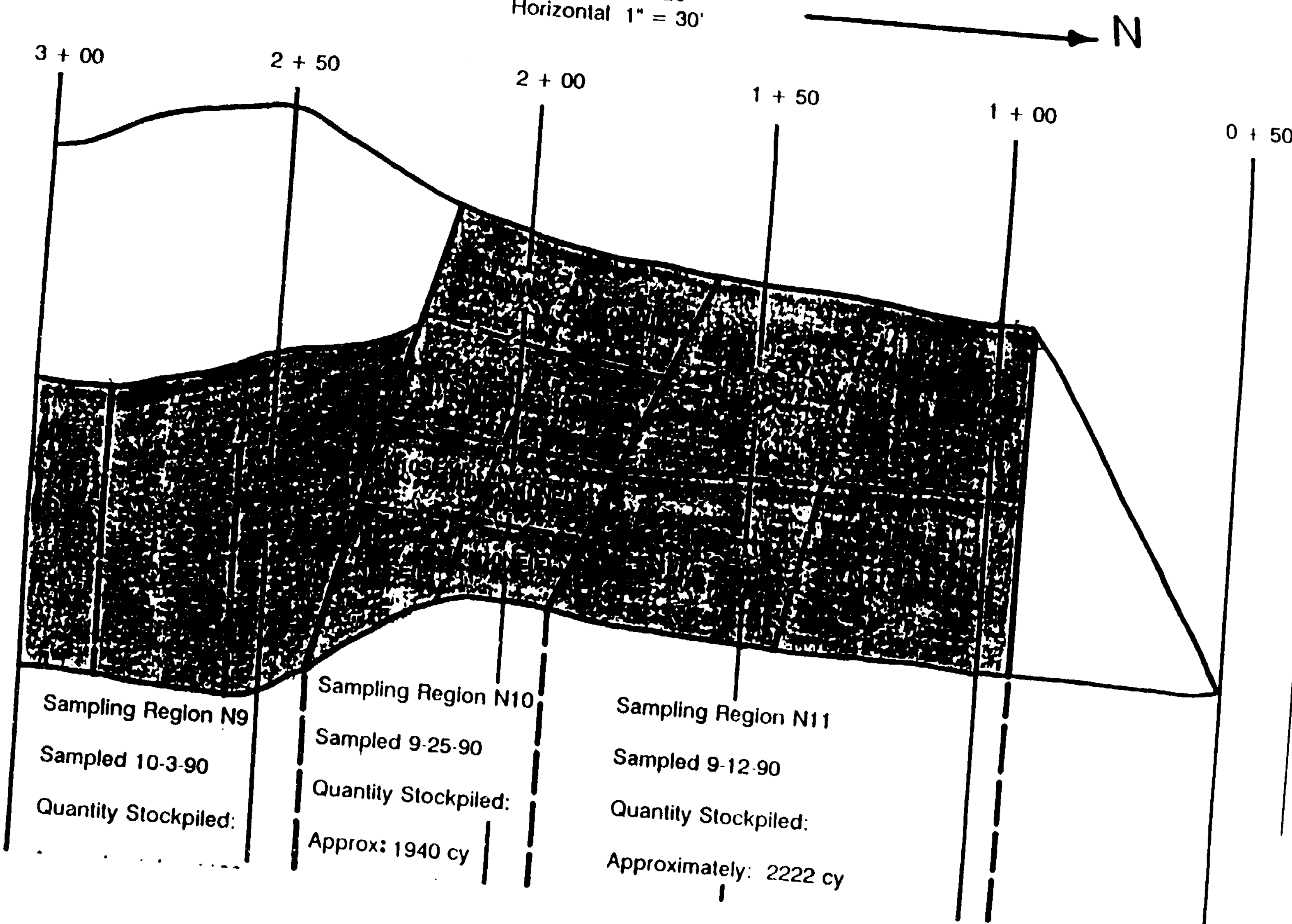


Figure 4-3B

4.5.2 Waste Profiles Sheets

A Waste Profile Sheet was prepared for each waste and approved by the receiving landfill. The disposal facility performed Quality Control tests to assure that the waste sent was within the parameters of the approved Waste Profile Sheet.

4.6 MATERIAL LOADING, TRANSPORT AND DISPOSAL

After the dewatered material was classified, trucks were loaded using track-mounted backhoes to a predetermined load limit. Each truck was lined to prevent leakage of entrained water released during transportation. Covers were placed to prevent airborne particulates during transport. Laborers covering the trucks were in Personal Protective Equipment Level C. Before departure from Cerro, trucks were decontaminated and weighed. A more accurate weighing was performed at a local, approved public scale in Sauget and then confirmed at the disposal facility prior to landfilling.

All polyethylene bags containing used personal protective equipment were placed in the trucks along with the contaminated sediments and shipped to the Chemical Waste Management, Emelle, Alabama landfill for disposal. Also, four (4) 55-gallon drums containing 726 kg total weight of personal protective equipment, sediment and water samples, and decontamination water were shipped to Emelle at the close of site activities.

Cerro Copper signed all manifests as the waste generator. Each manifest included the proper waste profile number. Disposal information has been submitted under separate cover.

Loading approximated 860 tons of dried sediments per work day from 24 September through 1 November 1990.

4.7 VAPOR BARRIER

To reduce the possibility of VOC emission from the Dead Creek area after sediment removal and backfill, a vapor barrier was installed. After granular material was deposited in Dead Creek to elevation 403', a 60-millimeter high-density polyethylene (HDPE) liner, protected by sand on both sides, was placed on top of this material and covered with select fill to grade (Vapor Barrier Certificate of Compliance, Section 6.4).

4.8 SITE RESTORATION AND EROSION CONTROL

The site was restored by constructing a well drained and graded parking area. Select material was placed in lifts no greater than 8 inches and compacted to a minimum dry density of 95 percent. A crushed rock surface was chosen to assure minimal wear and easy maintenance. Fencing which isolated the work site and all contractor temporary facilities and utilities was removed. All stormwater or surface water runoff was directed toward Cerro Copper's new stormwater handling system.

4.9 HEALTH AND SAFETY ISSUES

Protection of the workers and the surrounding community from exposure to hazardous substances was a primary concern.

4.9.1 Medical Surveillance Program

Each employee on the site maintained a current certification of completion of OSHA training required for hazardous waste workers. Contact was made with a local occupational health facility to provide each worker with an entrance physical. Exit physicals were offered to each employee upon termination of employment or completion of the project. Eight workers chose to take the examination; all were declared fit for work.

4.9.2 Air Emissions

Two air emission concerns were VOCs released during excavation and dewatering, and particulates released during the transportation and disposal phase. The site was monitored daily using an HNu Photo Ionization Detector (PID) and VOC levels recorded. Approved action levels were established by the on-site Health and Safety plan. Readings were taken, not only near the workers' area, but within the excavated Creek bed. During normal excavating operations, workers wore Level D protection as long as VOC levels remained below the VOC action level of 25 ppm, as specified in the Site Health and Safety Plan. When VOC levels were monitored above 25 ppm, workers upgraded to Level C personal protective equipment.

During the loading process, which took place within site boundaries, dewatered material passed the Paint Filter Test but was damp enough to prevent particulate emissions. During transportation, each truck was covered to keep particulates from release. Laborers covering the trucks wore Level C protective equipment during the loading process. The subcontractor, Chemical Waste Management, established its own action levels for utilization of personal protective equipment, which were different from those specified in the Site Health and Safety Plan.

4.10 COMMUNITY RELATIONS AND PARTICIPATION

The purpose of this program was to involve the community, local and state public officials, public interest groups and other interested/affected citizens and corporations in the removal action process. The community relations program was directed according to the community's needs for information.

The bulk of the contact with the community was performed by the IEPA's Community Relations Officer. Beginning in July 1985 when the IEPA sent letters to PRP's concerning their intent to conduct an SI/FS, the IEPA has maintained an open line of communications with the citizens and corporate community regarding Dead Creek.

On June 16, 1988, IEPA advised the community in a Public Notice that an E&E Report was available at the Cahokia Library and the Cahokia and Sauget Village Halls. Again on July 31, 1988, the IEPA released an Information Fact Sheet on the Sauget sites. A copy of the notices are in Attachment A.

During the followings months, Cerro and the IEPA met several times to discuss the potential for a removal action. During the Summer and Fall of 1989, Cerro performed a Site Investigation/ Feasibility Study. On January 16, 1990, Cerro provided the IEPA with a preliminary Status Report on the Site Investigation. On January 17, 1990, Cerro provided the Monsanto Chemical Company the same report provided the IEPA the day earlier.

After months of negotiation and discussion with the IEPA and the IAGO, on July 5, 1990, all parties came to an agreement and signed a Consent Decree. A joint press conference was held at the Dead Creek site to announce the agreement and the cleanup action to the public on that same date. Local media was on hand for the announcement. A copy of the press release is shown in Attachment E, along with a list of those attending the press conference.

On July 27,1990, Cerro notified State and Local Officials and Potential Affected Parties of the removal action. A copy of the notice is shown in Attachment C with the mailing list of those receiving the notice.

On July 30, 1990, a Public Information Record was set up at the Cahokia Library. Included in the record are copies of the Consent Decree, the SI/FS, the Work Plan, the Health & Safety Plan, the Engineering Bid Documents and monthly reports that were submitted to the IEPA. A copy of the letter setting up the Record is Attachment D.

On August 4, 1990 and August 8, 1990, a public notice appeared in the Belleville News-Democrat and the Cahokia-Dupo Herald, respectively, requesting public comments from the community. No comments were received by Cerro. A copy of the notices are in Attachment E.

5.0 RESPONSE ACTION COST SUMMARY

5.1	REMEDIAL INVESTIGATION/FEASIBILITY STUDY	$553,507
5.2	STORMWATER DIVERSION CONSTRUCTION	$2,619,857
5.3	REMOVAL ACTION COST	$10,388,617
5.3.1	Engineering	$188,176
5.3.2	Construction & Contract Management	$361,579
5.3.3	Analytical	$189,171
5.3.4	Excavation, Dewatering & Classification	$1,597,665
5.3.5	Loading	$204,695
5.3.6	Transportation	$1,889,448
5.3.7	Treatment and/or Disposal	$5,265,347
5.3.8	Vapor Barrier	$146,625
5.3.9	Site Restoration and Erosion Control	$545,910
5.4	IEPA OVERSIGHT	$36,000
5.5	LEGAL COST	$73,135
TOTAL PROJECT SPENDING		$13,671,116

**Note: Costs are subject to change pending final invoicing and adjustments.*